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The ferns and flowering plants of Nantucket—VII

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ROSACEAE

THE BLACKBERRIES

Blackberries are abundant on Nantucket, growing nearly everywhere except in the salt marshes. Low or trailing forms predominate, but the taller kinds are only less common and widespread. The visiting botanist who may be interested in blackberries will notice at once among some of the common eastern species others of less familiar aspect, and will shortly discover that the group as a whole embraces a numerous and variously interrelated series of forms, which give a problem in classification not easily solved. An attempt to understand these plants will find little or no help in published works, nor is the obscurity that invests them at all illuminated by the numerous descriptions of alleged new species, which of late years have found their way into print. In a recent paper* I have suggested that the solution of this blackberry problem is to be sought, not in a recourse to a large and dubious number of closely related new forms, but rather in a clear reading of the broad lines marked out by a comparatively few primary species, most of which were long ago well defined. It would seem to have eventuated in nature that each one of these primary species ranges structurally through a very wide orbit of variation, and that, in addition, all are involved in actual organic entanglement through a process of intercrossing,

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which, where encouraged by favoring conditions, has produced a highly complicated association of individualized forms.

Nowhere, perhaps, are to be found conditions more apt for marked variation and free hybridization in this group of plants than on Nantucket. Here, on an outpost island, removed from all direct influence of their general tribe, blackberries have for centuries grown and spread, acting and interacting under conditions of isolation and of group compression which could scarcely have failed to register some profound result in their structure and general economy. And scarcely in less degree must another influence have operated with modifying force in their local status. Within historic times the island has undergone almost complete deforestation. Subjected to a derangement so fundamental in their environment, already closely drawn, this insular group of blackberries must have experienced, superadded to their condition of physical isolation, a wholly new set of artificial conditions requiring some general readjustment of organic contacts among the species throughout the group.

It may be readily conceived that in the case of annual plants, or of species perennial by their roots alone, the effect of an environment so specialized and so modified, even though continued for a long period of time, might wholly fail to break through the organic individuality of old-time species, and thus fail of any appreciable expression. But it may be no less readily conceived that in the case of a group of plants such as the blackberries, perennial not alone by the simple root but by suckers as well, and in many cases by proliferous and rooting stems, a similar environment might well force a response in their morphology, which, once elicited, would be effectually shut off from escape. Variations of whatever degree in species so constituted would find instant protection and ready perpetuation in the mere activities of natural growth. An accidental hybrid multiplied by vegetative process alone into an established colony would be founded in the strong potency of becoming finally widespread. And it is not difficult to believe that the establishment of such a new form by vegetative reproduction would allow whatsoever period of time might be needed to reestablish any impaired capacity of reproduction by seed. It is worthy of note that many of these blackberries,

which appear to be clearly of hybrid origin, are not less fertile than their parent species. And here the possibilities in regard to compound or even decomposed hybrids opens widely on the view.

The treatment of the Nantucket blackberries which has been adopted in this paper, is allowed to rest frankly on the considerations here expressed in outline. The sufficient proof that many of our distinct appearing blackberries or, indeed, that any of them are of hybrid origin is yet to be forthcoming. The evidence relied upon in so regarding them is wholly circumstantial. And therefore, however well satisfied I may personally be of the hybrid origin of many of the plants here described, it must be understood that a mark of interrogation should apply to every one of them, first, as to its actual hybrid character and, second, as to whether if a hybrid the factors in its parentage have been correctly suggested.

The study of the blackberries of Nantucket, far from being completed, must be regarded as only just begun. With each succeeding visit to the island I have more acutely realized that a series of fleeting visits, wherein the entire flora was under observation, was wholly inadequate for an effective study of so exacting and recondite a problem as that which the group presents.

A series of specimens representing all of the hybrid blackberries herein described has been deposited in the herbarium of the New York Botanical Garden.

RUBUS STRIGOSUS Michx.

Abundant on Coskaty, and occasional in thickets on the eastern side of the island: Saul's hills; Rattlesnake Bank, Quaise, Polpis, Pocomo, and Squam. In full flower as late as June 20, 1910.

*RUBUS OCCIDENTALIS L.

Thickets at Shawaukemmo Spring, where it fruits abundantly and appears to be native; occasional by street sides and fence rows in the town and suburbs, appearing as if introduced.

RUBUS TRIFLORUS Richards.

Reported as a Nantucket plant in Mrs. Owen's catalogue, on the authority of Mr. Dame, from "bog near Sancoty" [Sankaty].

*RUBUS ALLEGHENIENSIS Porter.

Thickets at Watt's Run, a copiously glandular and pubescent form with rather short, closely flowered racemes, and flowers 2–3 cm. broad; in full flower June 15, 1908. A less glandular and less pubescent form at Quaise.

The Nantucket plant might be more particularly defined as the *R. nigrobaccus* of Bailey, if any distinction is to be made between this and *R. allegheniensis*.

RUBUS ARGUTUS Link.

R. floricomus Bld.

R. Andrewsianus Bld.

Frequent and locally common, but not generally distributed, occurring mainly on the eastern side of the island. In full flower June 17–28, 1910; fruit ripe Aug. 12, 1906. The tallest and finest-fruited blackberry of the island, becoming over six feet in height, although often much lower and sometimes with widely decurved branches. It varies greatly according to its situation, whether in dry or moist soil or in sun or shade; leaflets from suborbicular with cordate base to lanceolate-oblong and narrowly cuneate, sharp-serrulate to coarsely cut-serrate, densely velvety-canescent to cinereous-pubescent beneath, the lateral pair slender-stalked or subsessile; pedicels naked or well armed even on different parts of the same plant.

I am indebted to Dr. B. L. Robinson for a carefully executed copy of an original tracing by Dr. J. M. Greenman of the type specimen of *Rubus argutus* Link, preserved in the Berlin herbarium. This tracing is so closely a counterpart to specimens of the plant here discussed, from Nantucket and Long Island, that their identity with Link's species cannot be a matter of any doubt.

* RUBUS FRONDOSUS Bigelow.

Common in thickets and open grounds and passing readily from one to another form within marked extremes. The leaflets may be short and broad or narrow and tapering, and also vary greatly in marginal pattern and pubescence, from somewhat evenly dentate-serrate to irregularly laciniate and from loosely short-pubescent to almost villous beneath. In open sandy fields

the plant is sometimes quite prostrate, in better soils erect and recurving. Occasionally in damp shaded thickets, as on Rattlesnake Bank and in Pocomo, its stems ascending through the shrubbery become reclined and long-trailing over the bushes five or six feet above the ground. Such plants are usually characterized by thin and light green, long-attenuate, narrow leaves, but they pass imperceptibly into the more stocky and pubescent broader-leaved and darker green plant of more open ground. First flowers June 8, 1908; last flowers June 26, 1910; ripe fruit August 6, 1906.

The prevailing form of this species on Nantucket is recognizable as the plant which has been described as *R. recurvans* Bld. Should it be held that this plant is sufficiently divergent to merit specific standing, the nomenclature of the several hybrids of *R. frondosus* herein described should be correspondingly modified.

* RUBUS NIGRICANS Rydb.

The prevailing form on Nantucket of this, perhaps the most widely variable of all our blackberries, is notably different from any form of the plant I have met with elsewhere. Northward, or at higher altitudes, the species seems to tend towards delicate forms, often only sparsely bristly, with narrower and glabrate, brighter green leaflets; southward in coastwise swamps, or inland, coarser forms are found with larger, duller green, more pubescent leaves, and a more pronounced development of bristly armature, which is copiously glandular-hairy throughout. Forms similar to these are found occasionally on Nantucket, but the more usual form on the island is marked, in its extreme development, by its almost non-glandular character; dark purple, more or less angled stem, armed with strong, straight, acicular prickles, which are often swollen at the base; thick and shining glabrate leaflets, mostly suborbicular and obtuse and somewhat crenate-dentate; and a bristly almost non-glandular inflorescence, the calyx lobes glabrate to tomentulose and with or without setae and glandular hairs. This plant passes on the one hand into the coarser, more pubescent form above referred to with subterete, densely bristly and glandular-haired stems and narrower, obovate-oblong, acute, serrate leaflets, and on the other hand into a re-

duced and slender, sparsely weak-prickly form with prostrate or trailing flowering stems, small leaflets, and a simple, more racemose inflorescence. This smaller plant is often strictly trifoliolate and so nearly approaches forms of *R. hispidus* that the lines of distinction between the two become much confused if not quite obliterated. The petals vary like the leaflets and may be narrowly oblong or nearly orbicular.

Certain more pronounced examples of the broad-leaved trailing plant I was at first inclined to regard as involved with *R. flagellaris*, and they may be, but further study of the specimens seems to show that they are not necessarily other than an extreme variation of *R. nigricans*. Still, should anyone choose to esteem this Nantucket plant a distinct species it would not be difficult to concur.

My observation of the entire species seems to show that the coarser, more densely bristly and more pubescent forms are developed among the rank vegetation of heavier wet soils, and that the more spiny and glabrate forms belong to soils that are damp and sandy. In dry open places occur forms, either pubescent or glabrate, which are almost non-glandular and sometimes only sparsely armed with recurved bristles or prickles. Adjoining stems arising from the same root may be variously armed, and I have a specimen collected at Woodmere, Long Island, which strikingly illustrates the great variability of the plant, an almost unarmed, loosely pubescent stem arising side by side from the same root with one densely clothed with slender bristles and gland-tipped hairs but destitute of any proper pubescence.

Just in flower and in full flower at different stations on Nantucket June 22, 1910; some ripe fruit August 9, 1906.

RUBUS HISPIDUS L.

Common and very variable. Stems densely invested with weak, retrorse, bristly hairs or armed with few or many slender, straight or decurved hard prickles, and bearing gland-tipped hairs throughout or only on the growing parts; leaves from obovate or orbicular and crenate-dentate to cuneate, very acute and cut-serrate, the inflorescence with or without bristly or gland-tipped hairs, the calyx lobes glabrate to canescent, rarely with reddish glandular hairs; occasionally 5-foliolate leaves are produced.

First flowers June 18, 1910; at other stations not yet in flower June 24, 1910.

RUBUS PROCUMBENS Muhl.

Common and very variable; many specimens are uncharacteristic and apparently involved with other species. In full flower June 15, 1908, June 19, 1910; ripe fruit August 6, 1906.

* RUBUS BAILEYANUS Britton.

Frequent or common in dry thickets and pine groves. Flowers 2.5 cm. to over 5 cm. wide, the petals commonly very broad, often orbicular and nearly 2 cm. wide, actual measurements of the largest seen being 2.6 cm. long by 1.8 cm. broad. Freshly in flower June 11, 1908.

* RUBUS ENSLENII Trat.

Common in open sandy places, even in pure sand, and in dry pine groves. Flowers equally as broad as those of *R. Baileyanus* but with narrower, oblong petals; fruit subglobose, of medium size, with rather large drupelets, somewhat insipid and watery. First flowers June 4, 1909, June 7, 1908; ripe fruit August 7, 1906. Many examples match perfectly with specimens of *R. Enslenii* in the herbarium of the New York Botanical Garden from Virginia, Georgia, and Alabama.

* RUBUS FLAGELLARIS Willd. Enum. Hort. Berol. 549. 1809.

Prostrate, the long-trailing stems and branches soft and somewhat fleshy towards the ends and rooting freely at the tips; stems terete or subterete, smooth, often purplish; prickles usually few and scattered, sometimes almost wanting, acicular, or even bristle-form on the new shoots, very short and decurved, often with thickened base on the upper stem and branches; primary leaves 3-foliolate, on rather short, glabrous, or thinly pubescent petioles, 2–5 cm. long, armed like the stem; leaflets usually dark green, often purplish, or even deep purple when young, of firm texture, thickish, often subviscid to the touch, glabrate or bearing scattered appressed hairs on the upper surface, glabrous beneath or minutely subappressed-pubescent along the veins; leaflets variable in size, commonly 4–6.5 cm. long and 3–5 cm. wide but often smaller, closely and frequently very irregularly denticulate or denticulate-serrate to more openly dentate, the teeth abruptly acuminate, usually with firm incurved points; the odd leaflets orbicular or obovate-orbicular to broadly elliptic, abruptly short-acuminate,

rounded or cuneate at base; the lateral leaflets broadly rhombic and notched or cleft on the lower margin to form a prominent rounded lobe; flowering branchlets slender, angled, thinly pubescent, sparingly armed or unarmed, the lower becoming 2 dm. long, the upper much reduced; inflorescence, when fully developed, a loose corymbose, sometimes compound cluster of mostly 2–5 slender, erect or ascending pedicels and several, usually conspicuous, unifoliate, often deeply lobed, glabrate leaves sometimes 4–6 cm. wide; pedicels mostly 3–6 cm. long, thinly loose-pubescent to glabrate, unarmed or sparingly setulose, but destitute of glandular hairs, often bearing one or more green bracts, and occasionally branched; calyx lobes broad, minutely pubescent on the outer surface, white-tomentulose within, often with foliaceous termination; flowers not usually large, spreading 2–3.5 cm.; petals oblong or broader, narrowed towards the base; fruit subglobose to ovoid, often small but becoming of good size; drupelets large, large-seeded, thinly arachnoid-pilose when young and even at maturity, rather watery and insipid or acid.

Frequent or common in open sandy places and in pure sand. In fresh flower June 15, 1910; fruit ripe August 4, 1906. Frequent on Long Island.

The trailing blackberry, *Rubus flagellaris*, well defined by Willdenow over a century ago, has ever since been lost to the recognition of botanists. Professor L. H. Bailey has told us* that the type specimens are still in existence in the Berlin herbarium. Until actual comparison has been made of these specimens with the plant here brought to notice, a doubt may fairly be entertained whether the two are actually the same, although the evidence that they are would seem to be reasonably conclusive. Willdenow's species has been a continuing mystery. Bailey, who studied the type specimens, seems to have doubted whether it was an American plant at all. A particular interest therefore attaches to this Nantucket and Long Island blackberry, if it shall now finally dispel the mystery and resolve the doubt. That the original description of Willdenow applies to this plant with really close precision might not of itself be enough to justify a conclusion. But in addition it will be found that the illustration of the type specimens, presumably from a photograph, which Bailey has supplied,† leaves little to be desired in the way of convincing

*Evolution of our native fruits, 368.

†Loc. cit., 369.

evidence. It was this illustration, in fact, which first drew my attention to Willdenow's species in this connection and when, quite unexpectedly, it first met my notice it was impossible not to give it instant acceptance as an illustration of the Nantucket plant.

The species is, of course, allied to *R. procumbens* but differs in its softer stems, more sparsely and weakly armed, with smaller prickles, darker green and more coriaceous, glabrous or glabrate, trifoliolate leaves, which are subviscid to the touch, those of the shoots with the leaflets more finely denticulate, more obovate and short-acuminate, and often cuneate at base. In its typical form it also differs conspicuously in the greatly enlarged unifoliate leaves of the inflorescence. The leaves of the season's shoots in form, color, and texture, as well as in their often purplish color, often suggest those of *R. hispidus*, although usually larger, but the cross *R. hispidus*×*procumbens*, which thus comes to mind, proves to be actually a very different plant.

* RUBUS ALLEGHENIENSIS×ARGUTUS.

Erect, recurved above, 0.5–1.5 m. high, becoming widely branched; stem purplish, more or less angled and grooved, the new shoots and often the prickles sprinkled with minute, reddish, sessile glands; prickles numerous or few, slender, 3–5 mm. long, or, on stouter plants, becoming broad-based and 10 mm. long, straight and erect, on the branches becoming retrorse but scarcely decurved; primary leaves 5-foliolate, on slender pubescent petioles 4–8 cm. long sprinkled with reddish, sessile or occasionally short-stalked glands and armed with scattered, retrorse or decurved prickles; leaflets thinly appressed-pubescent above, minutely soft-pubescent beneath, narrow, lanceolate to oblong-lanceolate or ovate-lanceolate, often long-tapering, usually the odd one and often the middle pair cordate, unevenly denticulate-serrulate, the teeth acuminate, those terminating the larger veins often larger and slightly recurved; petiolules slender, pubescent, glandular like the petioles, those of the odd leaflets 1.5–3.5 cm. long, those of the lateral pair one-third to one-half as long; leaflets of the flowering branches usually bearing stipitate glands and often somewhat cut-serrate or laciniate; inflorescence of numerous short, often closely flowered racemes, which are sessile or terminate short branchlets, naked or with a few reduced unifoliate or trifoliolate leaves below, the axis thinly short-pubescent with spreading hairs and invested with numerous minute, short-stipi-

tate, purplish glands; flowers 6–16, their pedicels glandular, short, slender, spreading or ascending, unarmed or with occasional weak prickles; sepals green, lanceolate-attenuate, pubescent and glandular to glabrate; flowers small, the petals 1–1.5 cm. long, obovoid-oblong, sometimes tinged with crimson; fruit small, ovoid or subglobose, of rather small drupelets.

Met with at only two stations on the borders of low thickets near Shawaukemmo Spring. First flowers June 4, 1909; in full flower June 11, 1908; young fruit June 26, 1910.

The form of this plant, here particularly described, is distinguished by lanceolate, tapering, sharply denticulate-serrulate leaflets and small, narrow racemes, thickly invested with short-stipitate glands, unarmed pedicels, and rather small flowers, sometimes so brightly tinged with crimson as to have the appearance of apple blossoms.

At two places on Nantucket, plants were collected which are similar to this plant in general form and leaf shape but differ in their villous-pubescent almost non-glandular inflorescence, longer pediceled flowers, and sparse armature throughout. Similar plants occur on Long Island, in which the subterete purple stems are sometimes nearly unarmed and the inflorescence may be with or without stipitate glands even on the same specimen. In this form the racemes tend to be sessile and appressed along the upper part of the stem. Other specimens from Long Island are unmistakably referable to the typical Nantucket plant, even showing a tendency to crimson tinted flowers, but often differing by broader, more acuminate, and less irregularly cut leaflets.

* RUBUS ALLEGHENIENSIS × FRONDOSUS.

Stems of the first year erect, 0.75–1.5 m. high, often bearing scattered and deciduous stalked glands, sometimes remaining erect the second year, but more often recurving and declined or even partly trailing, simple or sparingly branched, purple, smooth, often terete or subterete, sometimes very sparsely armed, but commonly bearing remote or scattered, more rarely rather numerous prickles; prickles simple often broadened only at the extreme base, erect, straight or slightly curved, mostly 4–7 mm. long; primary leaves 5-foliolate or the lower 3-foliolate, on slender petioles 6–12 cm. long; petioles thinly pubescent to villous-tomentulose, bearing either scattered or numerous stalked glands; leaflets thin and soft, pale green, appressed-pubescent on the upper surface, paler and

closely short-pubescent or velvety beneath, denticulate to irregularly dentate-serrate with acuminate or attenuate teeth, ovate to ovate-oblong or oblong-lanceolate, acuminate, the odd one often cordate, its petiolule 2–4 cm. long, the lateral pair short-stalked; flowering branchlets rather short, usually confined to the upper part of the stem, the lower branchlets stouter and leafy; inflorescence racemose or somewhat corymbose, a few of the lower flowers subtended by reduced trifoliolate or unifoliate leaves; axis and pedicels short-pubescent with spreading hairs to tomentulose, bearing few or numerous stalked glands or sometimes obscure sessile glands only; pedicels slender, ascending or spreading, often weak and flexuous when young, 1–4 cm. long, unarmed or sparsely setulose; calyx lobes thinly pubescent to somewhat villous, with or without gland-tipped hairs, apiculate to caudate; flowers small or medium-sized, petals oblong to obovate, 1–1.5 cm. long; fruit apparently rather small, ovoid-subglobose, the drupelets medium-sized.

The foregoing description is derived primarily from specimens collected on Long Island, where the plant is frequent in open woodland.

It was met with only at two stations on Nantucket; thicket near Shawaukemmo Spring, first flowers June 11, 1908, and pine scrub near the fair grounds, in full flower June 17, 1908, both examples being only obscurely glandular and otherwise atypical.

The plant is ordinarily well characterized among allied forms by lax habit, sparse armature, long-petioled thin leaves, and short, subcorymbose, mostly glandular raceme. Occasional specimens are ambiguous and very puzzling, appearing to lie midway between typical examples and forms of *R. allegheniensis*×*argutus*.

* RUBUS ALLEGHENIENSIS×PROCUMBENS.

Shoots ascending, early recurved or declined, becoming very slender and flexuous and trailing over bushes or on the ground, simple or sparingly branched; stems more or less angled, sometimes furrowed below, purplish brown to bright purple, either sparingly armed or provided with numerous prickles mixed with scattered gland-tipped bristles and glandular hairs; prickles acicular above the broadened base or often bristleform, mostly 3–5 mm. long, straight, erect or slightly retrorse, or even decurved, especially on the petioles and petiolules; primary leaves 4–10 cm. long, 5-foliolate, even the lowest rarely 3-foliolate, often numerous;

petiolules thinly pubescent with loosely spreading hairs; leaflets often dark green, somewhat shining and sparingly appressed-pubescent to glabrate above, minutely pubescent beneath, acutely and unequally dentate or dentate-serrate; the lateral veins rather numerous, becoming prominent, the odd leaflet ovate to ovate-oblong, acuminate, cordate at the base, its petiolule short-pubescent to tomentulose, 1.5–4 cm. long; middle pair of leaflets oblong or somewhat rhomboid, tapering at the apex, somewhat narrowed to an entire, inequilateral, abruptly short-contracted, often cordate base, subsessile or short-stalked; trifoliolate leaves of the flowering stems often somewhat doubly serrate-dentate or cut-lobed; inflorescence corymbose-subracemose, naked or sparingly unifoliate-bracteate, sometimes slightly compound, terminating numerous leafy branchlets 5–20 cm. long, which do not usually extend into the terminal portion of the stem; pedicels slender, erect or spreading, 2–6 cm. long, thinly pubescent to tomentulose, unarmed or sparingly setulose, with the calyx bearing delicate gland-tipped purplish hairs of unequal lengths; calyx lobes oblong to lanceolate, short-tipped or caudate; flowers often rather small, becoming 2.5 cm. wide or wider; petals broadly oblong or obovoid; fruit rather small, ovoid or subglobose, the drupelets medium-sized.

Found at one locality near Wauwinet, and a single plant in Millbrook Swamp. First flowers June 11, 1909; in full flower June 20, 1910. Frequent on Long Island. In some of its forms this plant approaches so closely to forms of *R. allegheniensis*×*frondosus* that in the present state of our knowledge confident assignment of all specimens is scarcely possible. In general it differs from *R. allegheniensis*×*frondosus* in its more prostrate and slenderly trailing habit; smaller and more slender, more numerous prickles, often mixed with gland-tipped hairs or bristles; firmer, darker green, strongly venose leaflets, which are less densely pubescent beneath and more evenly dentate with shorter teeth, the middle pair often cordate; slender and flexuous, more numerous flowering branchlets, often wanting towards the upper part of the stem; more corymbose and glandular, often naked, inflorescence of slender-pediceled flowers.

* RUBUS ARGUTUS×FRONDOSUS.

Stout, erect, recurving above, becoming widely branched the second year; stem and branches yellowish green to dull purple, rigidly flexuous, angled and sulcate, or the branches subterete,

strongly and stoutly armed; prickles numerous, even crowded, compressed, straight or strongly hooked, especially on the branches and petioles, hard and sharp, often very large, becoming over 12 mm. long, and abruptly contracted from a widely expanded base; new shoots and sometimes the prickles pubescent or even villous; primary leaves on stout, strongly armed, often villous petioles 5–8 cm. long, 5-foliolate, except the lowest; leaflets rather thin becoming coarse and venose, loosely appressed-hairy on the upper surface, closely subspreading-pubescent or even velvety beneath, ovate-oblong to elliptic or oblong-lanceolate, irregularly denticulate or dentate-serrate to cut-serrate with very acute teeth; the odd leaflet mostly rounded or subcordate at base on a petiolule 2–3 cm. long, acuminate at the apex; middle pair of leaflets subsessile or on slender petiolules 1.5 cm. long; inflorescence a leafy, villous-pubescent, subcorymbose raceme, the flowers often descending to the lower axils, its axis stoutly armed with decurved yellowish prickles; pedicels 1–3 cm. long, armed with stout, yellowish, straight or decurved prickles, or rarely unarmed, the pubescence concealing minute sessile or subsessile glands; unifoliate leaves of the inflorescence usually conspicuous, sometimes numerous, broadly elliptic to lanceolate; sepals more or less subappressed-villose, usually with narrow subfoliaceous termination; petals oblong to obovate-oblong, mostly 1–2 cm. long; fruit ovoid, medium-sized.

This plant becomes perhaps the most stoutly armed of all our blackberries, and is further characterized by its leafy villous-pubescent and strongly armed subcorymbose raceme without stalked glands. Ordinarily it has rather small flowers and is not over 1.5 m. high.

Quaise, June 9, 1909, not yet in flower; June 11, 1908, first flowers; Watt's Run, June 20, 1910, just in flower; near Sachacha. Frequent on Long Island.

* RUBUS ARGUTUS×NIGRICANS.

R. ascendens Bld.

A few plants at the border of a thicket at Tom Never's Pond, August 31, 1904, bearing some imperfectly developed fruit. An erect rather slender form of the plant with straight and spreading acicular prickles and contracted inflorescence, its axis, as well as the pedicels and calyx lobes, bearing short gland-tipped hairs, the pedicels setulose.

* RUBUS ARGUTUS×BAILEYANUS.

Shoots erect or ascending, sometimes becoming over a meter in height, finally recurved or even declined, widely branched, the branches often elongated and trailing; stems stout and angled below, terminally becoming slender and subterete, usually deep reddish purple, strongly armed throughout; prickles mostly purplish, very numerous, often crowded, becoming 7 mm. long, commonly nearly straight and slenderly very acute, the base abruptly broadened, erect or slightly retrorse, often shorter, stouter, and decurved towards the ends of the branches and on the petioles; leaves rather dark green, often shining above, and of thickish texture, those of the main stem 5-foliolate, except the lowest; the leaflets somewhat irregularly dentate-serrate, sparsely hispidulous-pubescent on the upper surface, slightly pubescent beneath; odd leaflets broadly oval to oblong-ovate or obovate-oblong, acuminate, subcordate or rounded at the base, mostly 5–6 cm. wide, 6–8 cm. long, on a petiolule 1.5–3 cm. in length; middle leaflets mostly obovoid-oblong, contracted or narrowed to a short petiolule 2–10 mm. long; flowering branchlets numerous, pubescent, leafy, the leaflets often large and more coarsely and irregularly cut than in the primary leaves; inflorescence corymbose or doubly corymbose, subtended by one or two conspicuous unifoliate leaves, the lower flowers axillary from trifoliolate leaves; pedicels firm, slender, often branched, divergent, 1–3 cm. long, pubescent but without glandular hairs, well armed with slender slightly recurved prickles; flowers conspicuous, 2.5–3.5 cm. wide, the petals broadly cuneate-obovate, sometimes broader than long; calyx lobes tomentulose-pubescent, non-glandular, commonly with narrow subfoliaceous terminations; fruit abundant, of medium size, subglobose, 1–1.5 cm. broad; drupelets of good size, very black and shining.

Low grounds below the "Cliff," several vigorous clusters; in full flower June 23, 1910. Frequent in local colonies on Long Island.

A handsome and strongly characterized blackberry, usually found growing with *R. argutus*, *R. Baileyanus*, and *R. procumbens*, the two former species appearing to be its most probable parents.

* RUBUS ARGUTUS×PROCUMBENS.

Stems rigid, woody, angled and strongly armed, or in slender forms subterete, often more or less pilose-pubescent the first year, erect or ascending and recurving, sometimes trailing, becoming

widely branched, the branches declined or trailing; prickles usually numerous, hard, rigid, slenderly very acute, straight or somewhat decurved, or some slightly recurved, commonly 3–6 mm. long, shorter and usually strongly hooked from a broader base on the petioles and petiolules; primary leaves ascending, their petioles often 7–10 cm. long, 5-foliolate except low on the stem; leaflets usually rather light green, of firm texture, lanceolate-oblong to elliptic or more or less rhombic, often narrowly cuneate at the base, acute to narrowly acuminate at the apex, frequently subconduplicate, the terminal one often broader and somewhat rounded at the base on a stalk 1–3 cm. long; lateral leaflets on petiolules 5–15 mm. long, or rarely subsessile; upper surface of the leaflets sparsely appressed-pubescent to glabrate, the lower surface appressed-puberulent with silvery hairs; marginal pattern finely and acutely serrate or serrulate or sometimes more deeply and irregularly serrate, the teeth firm and very acute; flowering branchlets pubescent, angled, mostly 5–15 cm. long; inflorescence racemose-subcorymbose, usually bearing from one to several narrow unifoliate leaves; pedicels slender, divergent, mostly 1–3 cm. long, pubescent, nonglandular, usually bearing slender, somewhat decurved prickles; calyx lobes mostly lanceolate with narrow subfoliaceous termination, pubescent, often strongly 3-nerved; flowers medium-sized to rather large, 2–3.5 cm. broad; petals oblong to obovate-oblong narrowed into a claw; fruit medium-sized of rather few juicy drupelets.

The above description is drawn mainly from specimens collected in the neighborhood of Hewlett, Long Island, and from other well established colonies in low grounds of southwestern Long Island, at Lawrence, Woodmere, and Rockville Centre. On Nantucket a solitary plant only was met with. It was strongly established and trailing widely at the foot of the railroad embankment near the second mile, where it was in flower on June 19, 1908, and June 23, 1910, and bore ripe fruit on August 7, 1906. This plant is of more prostrate habit than any example observed on Long Island, and differs further in its broader, shorter, more dentate-serrate leaflets, which are also more pubescent and of darker color.

* RUBUS ARGUTUS × FLAGELLARIS.

Erect and recurved, ascending, or becoming prostrate and trailing, often branched; stems purplish, becoming rigidly flexuous, sometimes terete but commonly angled and striate; prickles scattered or numerous, hard, short and stout from a broad base,

or more slender and 5 mm. long, straight and erect or slightly retrorse, usually broader-based, decurved, and often numerous on the petioles and flowering branchlets; primary leaves 6–10 cm. long, mostly 5-foliolate, on strongly armed, thinly pubescent petioles; leaflets thickish and dark green, often rugose, loosely appressed-pubescent on the upper surface, paler and softly short-pubescent beneath, dentate-serrate with very numerous acute teeth; odd leaflet broadly ovate to orbicular, even broader than long, rounded or cordate at base, short-acuminate, becoming 7 cm. long and 6.5 cm. broad, but often smaller, its petiolule 2.5–3.5 cm. long; middle pair mostly elliptic-obovate, rounded or somewhat narrowed towards the base, on short footstalks 2–10 mm. long, the basal pair broadly elliptic; flowering branchlets numerous, often erect along prostrate stems, leafy, mostly 10–20 cm. long, angled and becoming stout and stiffly flexuous, somewhat villous-tomentose, often strongly armed; their trifoliolate leaves mostly 3 or 4, on rather short petioles, succeeded above by 3–5 conspicuous, short-petioled, orbicular or suborbicular, often cordate, incised or lobed unifoliate leaves subtending the pedicels; inflorescence a short, corymbose, leafy-bracted raceme, sometimes descending by slender-pediceled axillary flowers or rudimentary corymbs to the base of the branchlet; pedicels erectly ascending, 2–4 cm. long, with the calyx villous-tomentulose, armed with rather stout, spreading or slightly decurved prickles; calyx lobes sometimes sparingly setulose, often with foliaceous prolongation; flowers full-petaled, becoming 4 cm. wide; petals oblong to obovate.

Local by roadsides and borders of thickets, especially along the Quidnet and Wauwinet roads, near Polpis and in Pocomo; Siasconset; one cluster by the roadside near the old mill. First flowers June 12, 1909; in full flower June 16–24, 1910. A noteworthy blackberry, well characterized among the semiprostrate forms by its straight, stout prickles, dark green and rugose primary leaves with broad often orbicular leaflets, leafy flowering branchlets, and suborbicular and incised unifoliate leaves of the prickly inflorescence. It is closely related to the plants herein described as *Rubus flagellaris* × *frondosus* and *Rubus Baileyanus* ×*frondosus*, and some specimens afford the suggestion that the latter may be involved in its parentage. Its stronger forms, however, seem to reveal hints of both *Rubus argutus* and *Rubus flagellaris*, and I know not to what influence other than that of the latter its orbicular denticulate leaflets may be attributed. That

it is a hybrid is indicated by its locally sporadic occurrence and its relationship to other Nantucket forms that are not less certainly of hybrid origin. Somewhat at variance with its more characteristic forms is a weaker, less spiny plant, having paler green leaves with less rounded leaflets, which though quite possibly a phase of the same cross, may include some other element.

* RUBUS FLAGELLARIS × FRONDOSUS.

I have placed here a blackberry nearly related to *R. argutus* × *flagellaris*, but differing as follows: Stems more slender and terete, sparingly if at all branched, less purplish in color, more sparsely and less strongly armed with shorter prickles; pubescence less dense and tomentulose, often scant; leaves thinner and paler green, the marginal pattern more serrate and often more coarsely cut; primary leaves smaller, the odd leaflets broadly ovate to ovate-oblong, often with somewhat narrowed base; flowering branchlets and pedicels more slender.

This plant, like the preceding, suggests close relationship to *R. Baileyanus* × *frondosus* but is obviously not the same. It appears to differ much as a hybrid of *R. frondosus* might be supposed to do where *R. flagellaris* had replaced *R. Baileyanus* as one of the parents. Certain specimens which it seems necessary to refer here appear too close to examples of *R. argutus* × *flagellaris*, but other specimens are not to be reconciled with that cross. The plant is, in fact, somewhat intermediate between *R. argutus* × *flagellaris* and *R. Baileyanus* × *frondosus*. The very close relationship of many of these plants and the essential identity of certain of their characters lend support to the probability of their being crosses of nearly related parents.

* RUBUS FRONDOSUS × NIGRICANS.

R. abbrevians Bld.

Sometimes erect but more often recurved and spreading or partly trailing, simple or sparingly branched; stems often becoming deep red-purple, subterete to somewhat angled, densely armed, or sometimes only sparsely armed in weak plants; prickles of very unequal size, erect or slightly retrorse, straight or nearly so, acicular, the larger becoming 6 mm. long from a broadened base, the smaller diminishing into gland-tipped hairs, which usually invest the upper part of the stem; primary leaves 5-foliolate

or 3-foliolate, on loosely pubescent petioles, which are 5–10 cm. long and bear slender retrorse prickles and gland-tipped hairs; leaflets deep green, broad, rather thin, loosely appressed-pubescent on the upper surface, softly subspreading-pubescent beneath, dentate-serrate with very acute, somewhat uneven teeth; the odd leaflet ovate to obovate-orbicular, abruptly acuminate at apex, rounded or subcordate at base, becoming 5–6 cm. long by 4–5 cm. wide, its stalk 1.5–2 cm. long; middle leaflets not so broad, often somewhat rhombic, subsessile or short-stalked; inflorescence a short raceme or partial corymb terminating a broadly leafy branch bearing several trifoliolate coarsely dentate leaves and one or more conspicuous suborbicular and cordate unifoliate leaves; axis and pedicels villous-pubescent, invested with unequal spreading bristles and gland-tipped hairs; pedicels slender, 1–3 cm. long, axillary from conspicuously green, entire or 3-cleft bracts, or the lower from unifoliate leaves; sepals villous-pubescent, minutely setulose and glanduliferous; flowers of medium size, the petals sometimes sharply denticulate and fringed above with woolly hairs.

A well-established colony near Long Pond, also in Trot's Swamp. Not yet in flower June 1, 1909; first flowers June 10, 1908; passing out of bloom June 22, 1910.

* RUBUS FRONDOSUS×HISPIDUS.

R. biformispinus Bld.

Very variable; erect and 3–10 dm. high to ascending and recurved, or the flowering stems and branches declined and trailing; stems greenish purple to dull purple, simple or sparingly branched, slender, slightly angled, especially above, or terete; prickles few or numerous, variable in size and shape, mostly straight and erect, the largest becoming 4–6 mm. long, from a stout, much broadened base, and usually scattered, those of smaller size, when present, often numerous, sometimes even borne on the broadened bases of the larger ones, very unequal, many being reduced to mere swellings of the epidermis, others slender and passing into short bristles or gland-tipped hairs; primary leaves 3-foliolate or, on stouter plants, 5-foliolate; the petioles slender, becoming 10 cm. long, loosely pubescent and bearing decurved prickles and sometimes scattered gland-tipped hairs; leaflets rather deep green, often thickish and somewhat shining above, thinly appressed-pubescent on the upper surface, pubescent beneath with shorter subappressed hairs or glabrate, acutely and somewhat irregularly serrate or dentate-serrate, abruptly short-acuminate, the odd leaflet broadly ovate or ovate-oblong to elliptic or elliptic-obovate,

rounded or subcordate at base, 4.5–7 cm. long, 2.5–5 cm. wide, the stalk about 2 cm. long; middle leaflets obovate-elliptic or oblong, rounded or somewhat cuneate at base, subsessile or on petiolules sometimes 1 cm. long; flowering branchlets 8–15 cm. long, bearing below about two frequently reduced trifoliolate leaves and above a single, oval or orbicular, often cordate, unifoliate leaf; inflorescence a slender pubescent raceme, its axis sparsely setulose and bearing some slender gland-tipped hairs; pedicels slender, ascending, or spreading, 1–3 cm. long, subtended by greenish bracts or the lower axillary from the leaves, unarmed or nearly so, pubescent and bearing few or numerous gland-tipped hairs; calyx lobes softly pubescent, attenuate; flowers rather small, 1.5–2.5 cm. wide; petals oblong to obovate-oblong.

Bank of Reed Pond, June 18, 1910, in full flower, erect-ascending and partly trailing forms; Tom Never's Pond in low thicket, erect form; not yet in flower June 13, 1908, in full flower June 24, 1910. On Long Island I have collected a similar erect form from a single colony near Jamaica.

Widely different aspects are presented by the erect and the partly trailing states of this plant, and but for their obvious intergradation two different crosses might be supposed. In the erect forms the racemes are sometimes almost without glandular hairs and are small and somewhat appressed along the upper part of the stem. On the spreading forms the larger racemes terminate conspicuously leafy branchlets, and the pedicels are often clothed with gland-tipped hairs, sometimes twice the length of the pubescence.

* RUBUS FRONDOSUS×PROCUMBENS.

R. multispinus Bld.

At several stations. In full flower June 18, 1908; ripe fruit August 4, 1906, September 20, 1899.

Stems commonly more slender and trailing than in *Rubus argutus×procumbens*, armed with fewer, shorter and broader-based, more hooked prickles; leaves more pubescent, more ovate and long-acuminate, the marginal pattern more coarsely serrate; inflorescence more leafy-bracted and corymbose, with longer, more erect pedicels.

* RUBUS BAILEYANUS×FRONDOSUS.

Erect-recurving, ascending, or prostrate and trailing, simple

or widely branched; stems dull green to deep purplish brown, usually thinly pubescent the first year, angled to subterete; prickles rather numerous, short and strong, 2–4 mm. long, mostly straight and somewhat retrorse on the season's shoot, becoming uncinate on the flowering stems and branches and, especially, on the somewhat villous-pubescent petioles; primary leaves rather light dull green above, paler beneath, 5-foliolate or 3-foliolate, the petioles mostly 5–8 cm. long; leaflets thinly subappressed-villous on the upper surface, softly subspreading short-pubescent beneath, ciliolate, denticulate-serrulate and frequently also irregularly somewhat cut-lobed; odd leaflet broadly ovate-oblong to obovate, mostly 5–8 cm. long and 3–5 cm. wide, abruptly short-acuminate, rounded at the base, its petiolule 1.5–2.5 cm. long; lateral leaflets obovate- or elliptic-oblong, often rhombic, narrowed to the base, and tapering to an acuminate apex, sessile or nearly so, the lower pair short and deflexed; flowering branchlets short, often numerous and approximate, somewhat villous with a cinereous pubescence, bearing 3–4 trifoliolate leaves and above them one or more unifoliate leaves in the corymbiform raceme; pedicels 1–4 cm. long, villous-tomentulose, armed with short straight prickles; calyx lobes ovate-oblong, apiculate to subfoliaceous-acuminate, densely pubescent on the outer surface, white-flocculent within; petals conspicuous, broadly oblong to obovate-orbicular, sometimes 2 cm. long, the flowers 2.5–3.5 cm. wide; fruit ovoid-oblong, of good size, becoming 2.5 cm. long, pulpy but rather large-seeded, of indifferent flavor.

Common; first flowers June 8, 1908, June 12, 1909; passing out of bloom June 26, 1910. Fruit ripe August 2, 1906.

A characteristic blackberry of Nantucket, growing in dry or damp sandy soil about the borders of thickets or in open situations. It bears the aspect of an established species and may, indeed, be a factor in some of the crosses that have been ascribed to other parentage. If of hybrid origin it seems nevertheless to have acquired a detached and independent existence and is, perhaps, less often found in close association with its supposed parents than apart from them. Evidence of its origin as a cross may be deduced from its localized habitat, its intermediate character between *Rubus frondosus* and *Rubus Baileyanus* or *Rubus procumbens*, and the fluctuations of its variable forms towards one or the other of these species. Furthermore, on Long Island, forms occur which although not identical with the Nantucket plant are yet so similar to it that any fundamental difference between them

is not to be supposed. Such Long Island plants are of casual occurrence only and are quite certainly hybrids, apparently crosses of different local forms of the same parents that have produced the Nantucket plant. The Maine plant, which has been described as *Rubus arenicolus* Bld., is again similar to but not identical with the Nantucket plant, forms of which, however, approach it very closely.

* RUBUS ENSLENII × FRONDOSUS.

Erect and recurved, or ascending and reclined; stems simple or sparingly long-branched, purplish tinged, rather soft and becoming somewhat wrinkled-striate when dry, sparsely armed with short, slightly retrorse weak bristles, or slender and nearly unarmed, or again stouter and bearing numerous bristles below and occasionally stronger prickles; leaves rather small on slender, unarmed or nearly unarmed petioles, 3-foliolate or 5-foliolate; leaflets rather light green, ovate-oblong, or rhombic, acute or acuminate at the apex, rounded or narrowed at the base, rather coarsely and irregularly dentate or dentate-serrate, sparsely appressed-pubescent on the upper surface, softly and finely pubescent beneath, the lateral pair sessile or very short-stalked; inflorescence rather few-flowered, subcorymbose on short leafy branchlets, which are softly subappressed-pubescent, glandless and unarmed; pedicels very slender, even flexuous, 1–3 cm. long, the lowest axillary from one or two trifoliolate leaves, the one or two next above subtended by unifoliate leaves; sepals oval-oblong, blunt-apiculate to subfoliaceous-attenuate, thinly or sometimes softly subappressed-pubescent, casually with a few very short gland-tipped hairs; flowers apparently medium-sized; fruit rather small and seedy.

The description refers to plants collected on the Hempstead Plains, Long Island, which are somewhat intermediate between *R. frondosus* and *R. Enslenii*, but are not fully mature and have probably allowed only a very imperfect definition of the hybrid. A plant collected on Nantucket, near Shimmo farm, June 7, 1908, not yet in flower, seems to belong here but differs from the Long Island plant in its stiffer, more woody stem, larger and stronger prickles, looser pubescence, and larger but narrower, more coarsely cut leaflets. Another Nantucket plant, which may well be a form of this cross, occurs about the borders of thickets in dry exposed places. It is often erect or nearly so and differs from the Long Island plant in its more numerous, stouter prickles, orbicular or

obovate finely dentate-serrate leaflets of the primary leaves, and less slender pedicels usually armed with scattered and slightly decurved prickles.

* R. HISPIDUS×NIGRICANS.

I place here a plant collected in Trot's Swamp, June 10, 1908, not yet in flower, which is neither *R. hispidus* nor *R. nigricans*, although combining characters of both and growing with them. The stems are rather densely bristly-prickly with some interspersed gland-tipped hairs on the growing parts; the leaves are mainly trifoliolate, with broad rounded leaflets, which are minutely pubescent on the veins beneath and crenate-dentate to somewhat crenate-lobed; the inflorescence, not fully developed, is a raceme, the pedicels subtended by conspicuous greenish bracts, the pedicels and calyx bearing some slender setulae and gland-tipped hairs. Some of the reddened persistent leaves of the preceding season are indistinguishable from similarly persistent leaves of *R. hispidus*, and the racemose inflorescence and slenderly prolonged flowering stems seem to belong to that species; on the other hand the immature, suberect and angled new stems, some of the leaves, and the bracted inflorescence are much more nearly those of *R. nigricans*.

* RUBUS HISPIDUS×PROCUMBENS.

Shoots erect or ascending, the flowering stems prostrate and trailing, sometimes greatly elongated; stems greenish to dull purple, simple, slender, terete; prickles often bright red-purple, either few or numerous, straight, erect or slightly retrorse, acicular, often weak, 1–5 mm. long, sometimes stouter and decurved from a broader base; primary leaves either 3-foliolate or 5-foliolate, on slender, ascending, thinly pubescent or glabrate petioles 3–10 cm. long, armed like the stem; leaflets of firm texture, rather dark green, somewhat shining above, paler beneath, sparsely appressed-pubescent on the upper surface, minutely pubescent beneath or glabrate except on the primary veins; odd leaflet ovate or elliptic to obovate, acute or short-acuminate, rounded or subcordate at base, its petiolule 1–2 cm. long, the middle leaflets on very short stalks; paired leaflets of trifoliolate leaves mostly broadly rhomboid and usually notched or cleft to form a prominent basal lobe; flowering branchlets slender, pubescent, unarmed, or with a few weak prickles, often zigzag, the largest 2.5 dm. long, commonly bearing 2–4 rather distant trifoliolate leaves and one to several

unifoliate leaves in the inflorescence, the leaflets elliptic to obovate-oblong or cuneate-obovate, blunt or acute, serrate to unequally cut-serrate; inflorescence varying from a short terminal subcorymbose cluster of a few flowers to a loose and elongated leafy raceme; pedicels slender, rather densely pubescent, unarmed or sparsely slender-setulose, occasionally with an obscure glandular hair; calyx lobes thinly to rather densely subappressed-pubescent, non-glandular and unarmed; petals oblong to obovate-oblong, often small but becoming 10 mm. long, sometimes pinkish tinged.

Bank at Reed Pond, June 18, 1910, just in flower: season's shoots erect, 7 dm. high; flowering stems prostrate and long-trailing; leaves firm and deep green, shining above; inflorescence an elongated leafy raceme.

This seems to be an exceedingly variable cross. Certain specimens collected on Long Island are scarcely to be distinguished from examples of *R. vermontanus* Bld., although other specimens distributed as *R. vermontanus* are clearly different and probably represent hybrids of *R. hispidus* with *R. canadensis*.

* RUBUS ENSLENII×HISPIDUS.

Low, 3–6 dm. high, erect, often recurving above, or the flowering stems sometimes declined or even prostrate and trailing, usually unbranched; stems slender, terete or slightly angled, greenish to brownish purple; prickles weak and bristleform, short, 1–3 mm. long, numerous or few or sometimes almost wanting, straight and erect or slightly decurved; primary leaves 3-foliolate or 5-foliolate, on slender, ascending, loosely pubescent and weakly armed petioles 4–6 cm. long, light green and thinly appressed-pubescent to glabrate on the upper surface, paler beneath and minutely subappressed soft-pubescent, at least on the veins; leaflets elliptic-obovate to narrowly obovate-oblong, or the pairs oblanceolate, narrowed or contracted to the acuminate or tapering apex, gradually narrowed towards the mostly entire base, rather finely serrate above or denticulate-serrate or sometimes incised; the odd leaflet mostly 5–7 cm. long, 1.5–3.5 cm. wide, on a petiolule 5–10 cm. long; flowering branchlets numerous, slender, mostly 6–12 cm. long, pubescent, unarmed, their trifoliolate leaves rather small and short-petioled, often spreading, the leaflets elliptic to obovate-oblong and more or less rhombic, acute or acuminate at the apex, mostly narrowed towards the base, serrate or somewhat cut-serrate, varying to cuneate, and somewhat crenate-dentate; inflorescence a short pubescent raceme of close, slender, finally widely spreading pedicels, subtended by greenish bracts, or the

lower by unifoliate or trifoliolate leaves; pedicels and calyx subtomentulose, either unarmed or sparsely setulose, usually bearing short gland-tipped hairs; calyx lobes ovate, green-apiculate; flowers rather small, the petals narrowly oblong to obovate, 0.75–1.25 cm. long; fruit subglobose, 1–1.5 cm. long and wide, drupelets large, becoming 5 mm. in diameter, red or tardily black, but quite edible while red.

A very local plant of low grounds on Long Island, beginning to flower in the first and second weeks of June, the fruit ripening about the middle of August. On Nantucket a single plant was collected in sandy low ground below the "Cliff," bearing unripe fruit on August 4, 1906. This, while closely similar to Long Island specimens, differs in its smaller primary leaves with shorter more abruptly acuminate and more coarsely dentate-serrate leaflets, the leaflets of the flowering stems cuneate-obovate and crenate.

In habit and character this blackberry stands out rather notably from any other known to me. Its distinctive appearance might seem to give it standing as a valid species, but so it is with many another blackberry hybrid; and the very local occurrence of this plant on Long Island and the discovery of only a solitary individual on Nantucket would scarcely lend support to any other view than that it is of hybrid origin. Even so I am not at all assured that its parents have been correctly surmised. Actually the plant seems to bear more the suggestion of *Rubus nigricans* than of either of the species suggested as its progenitors, yet I have never found it in association with this species as I have with the others, and, furthermore, there seems to be no unknown cross of *Rubus nigricans* to which it might be referred, unless some one of these crosses has been misinterpreted.

* RUBUS FLAGELLARIS × HISPIDUS.

Prostrate and long-trailing or the new shoots ascending, often widely branched and rooting at the tips; stems slender, terete, becoming purplish or bright purple, armed with scattered or numerous, very slender, straight, and erect or slightly retrorse bristles, which are occasionally intermixed with gland-tipped hairs towards the base of the stem and sometimes pass into short decurved prickles on the older stems and branches; primary leaves 3-foliolate or 5-foliolate on slender glabrate petioles 4–9 cm. long, naked or armed with acicular, retrorse prickles; leaves firm and

membranous, dull green and sparsely subappressed-hirsutulous on the upper surface, paler beneath and glabrous or obscurely pubescent along the veins, the primary veins few with broad interspaces; leaflets broad, 3–6.5 cm. wide, 4–6 cm. long, the odd one often wider than long, abruptly contracted to a short, often curved acumination, broadly rounded or subcordate at the base; middle pair of leaflets similar but inequilateral, all more or less distinctly crenate-lobed, the lobes dentate with erect, uneven, acuminate teeth; flowering branchlets slender, 5–15 cm. long, glabrous, unarmed or sometimes sparingly setulose, often leafy towards the base and in the inflorescence and having an elongated naked interval, leaves trifoliolate, on slender, glabrous or thinly pubescent petioles 2–4 cm. long, usually weakly setulose; leaflets on the flowering branches often purple, small, mostly ovate or obovate and rhombic, the odd one often cuneate, on a very slender stalk 5–10 mm. long, firm and membranous, narrowly cleft into numerous close, acutely denticulate lobes, or even subpalmatisect, the margins often crisped; inflorescence a loose subcorymbose raceme of slender-pediceled flowers, the lower subtended by one or more trifoliolate leaves, and one or all of the others by small unifoliate leaves; pedicels very slender, 1–4 mm. or even 6 mm. long, glabrous or obscurely puberulent, unarmed or bearing weak purplish bristles and often also minute, scattered, sessile or short-stalked, purplish glands; calyx lobes glabrous to puberulent, canescent-tomentulose within, usually caudate or with foliaceous termination; flowers often small; petals oblong, 0.75–1.5 cm. long; fruit apparently rather small and seedy.

In open sandy places, sometimes in pure white sand. South of the town, June 10, 1909, not yet in bloom; Gibbs' Pond, June 18, 1908, just in flower; Quidnet, June 20, 1910, just in flower; Beechwood farm, June 26, 1910, just in flower; Gibbs' Pond, August 7, 1906, ripe fruit.

A very distinct appearing blackberry and perhaps exclusively a Nantucket plant. I have seen nothing like it from anywhere else. While some of its phases seem to point to close relationship with *Rubus flagellaris*, suggestions of *Rubus hispidus* are not to be overlooked, and I have found the three plants growing together. It is therefore here proposed as a hybrid, but I am even less satisfied than in certain other cases as to its parentage or even that it may not be a valid species.

* RUBUS BAILEYANUS×PROCUMBENS.

R. procumbens var. *roribaccus* Bailey.

R. roribaccus Rydb.

This plant, as I understand it, although subject to much variation, is stouter and more copiously armed throughout than either *R. Baileyanus* or *R. procumbens*, and has ascending early shoots which become long-trailing and much branched. It is further and especially characterized by 5-foliolate primary leaves, on strongly armed petioles, with large, coarsely and acutely doubly dentate or incised, thinly pubescent leaflets; the terminal one very broad, even broader than long and sometimes 9 cm. wide; the middle pair often on slender petiolules 5–10 mm. long; the inflorescence is a loose corymbiform raceme of 3–7 flowers, on elongated and erect pedicels becoming 6–8 cm. long; the pedicels are often copiously armed, frequently invested with gland-tipped hairs, and subtended by very large unifoliate often lobed leaves; the flowers are smaller than in *R. Baileyanus*, with narrower petals, the sepals often setulose and foliaceous.

Met with at only two stations on Nantucket: dry sloping field southwest of Millbrook Swamp, June 9, 1908, not yet in flower, and along the railroad about the second mile, June 23, 1910, passing out of bloom. In specimens from both of these stations the inflorescence is less conspicuously leafy than certain forms collected on Long Island, in which the unifoliate leaves are sometimes 6–8.5 cm. broad.

* RUBUS ENSLENII × PROCUMBENS.

R. geophilus Bld., in part.

Prostrate and long-trailing, often with elongated branches, the new shoots sometimes ascending; stems slender, terete, soft, weakly armed with very small scattered prickles or almost unarmed; prickles very short, rather broad-based, mostly retrorse or decurved; primary leaves 5-foliolate or some 3-foliolate, on slender, thinly pubescent, sparsely armed petioles 3–5 cm. long; leaflets rather thin, dark green and sparsely appressed-pubescent on the upper surface, paler and minutely subappressed-pubescent to glabrate beneath, acutely serrate to dentate-serrate, often with irregularly cut teeth; odd leaflet rhombic-ovate to ovate-oblong, rounded or subcordate to subcuneate at base, on a stalk 0.5–2 cm. long, attenuate or acuminate at apex, sometimes cleft below to form two basal lobes, or not seldom parted bilaterally into a distinct pair of accessory leaflets, making the leaf quasi-pinnate and

7-foliolate; middle pair of leaflets mostly narrowed and entire towards the base, often rhombic-lanceolate and subfalcately attenuate; basal leaflets narrowly oblong, often much deflexed; flowering branchlets often numerous, or clustered, thinly spreading-pubescent, unarmed or with a few small prickles, their leaflets oblong to narrowly lanceolate-attenuate, openly dentate with rather coarse acute teeth to appressed-serrate; inflorescence a few-flowered corymbose raceme, either short and terminal or the flowers descending in the axils of the trifoliolate leaves, commonly bracted with one or two oblong or lanceolate unifoliate leaves; pedicels very slender, erectly ascending, mostly 2–6 cm. long, loosely pubescent, unarmed or with a few minute prickles; calyx lobes ovate-oblong, herbaceous-apiculate to short-caudate, often softly appressed-pubescent; flowers medium-sized; petals narrowly oblong to obovate-oblong, 1–2 cm. long; fruit ovoid or subglobose, of medium size, the drupelets sparsely pilose.

Frequent about patches of low thickety growth in dry open places. First flowers June 7, 1908, June 9, 1909; last flowers June 26, 1910.

* RUBUS FLAGELLARIS × PROCUMBENS.

Prostrate and long-trailing; stems branching towards the end and rooting at the tip, rather coarse, soft, greenish and subherbaceous, terete, in great part unarmed but here and there bearing scattered, very short, broad-based and decurved, rather blunt prickles; primary leaves large, trifoliolate, on glabrate or thinly pubescent petioles, which are 5–7 cm. long and armed with scattered decurved prickles; leaflets very broad, becoming 8 cm. wide and 8–10 cm. long, the odd one orbicular or orbicular-obovate, rounded or abruptly narrowed to the base, short-acuminate at the apex, on a petiolule 2–3 cm. long; lateral leaflets mostly cuneate-obovate, often inequilateral and somewhat lobed on the lower margin, subsessile or on short petiolules; leaflets all coarsely and acutely dentate or irregularly cut-dentate, the teeth fewer and passing into appressed serratures towards the entire base; upper surface hispidulous, the lower surface minutely pubescent; flowering branchlets often clustered, 10–20 cm. long, green and herbaceous, striate, glabrate or puberulent, unarmed; inflorescence an irregular long-pediceled, racemose cyme; peduncles often rather stout and clavate above, puberulent, unarmed, the lower axillary from trifoliolate leaves, the upper often subtended by one or more unifoliate bracts; leaflets of the flowering branchlets mostly cuneate-obovate and deeply and irregularly serrate-dentate or laciniate; calyx lobes somewhat villous-pubescent, slender-caudate;

fruit insipid or subacid, large, broader than long, becoming 14 mm. wide; drupelets very large, up to 8 mm. in diameter, bearing scattered pilose hairs.

A single specimen only of this plant was met with, trailing along the border of a low thicket in Millbrook Swamp, August 9, 1906. It has proved to be a particularly perplexing plant. The very large, rounded, and coarsely dentate leaflets of its strictly trifoliolate leaves, coarse subherbaceous and nearly unarmed stem, clustered leafy branchlets, stiff elongated pedicels, and large drupelets give it signal distinction. It can scarcely be doubted that it is a hybrid, and unless it be a compound hybrid, I am at a loss where else to place it than under the parentage here suggested. If a compound hybrid, some involvement with *R. Baileyanus* or *R. Enslenii* might be suspected.

* RUBUS BAILEYANUS×ENSLENII.

R. geophilus Bld., in part.

Ascending, or prostrate and long-trailing, mostly unbranched; stems terete, slender, flexuous, varying from soft and subherbaceous and nearly unarmed to more woody with rather numerous prickles; prickles small, straight and more or less retrorse to rather broad-based and decurved; primary leaves in full development 5-foliolate, on loosely villous-pubescent to glabrate petioles 5–10 cm. long, which are sparsely and weakly or sometimes more strongly armed; leaflets bearing scattered, loosely appressed hairs on the upper surface, thinly short-pubescent beneath, coarsely and acutely doubly dentate or dentate-lobed to somewhat crenately doubly dentate; the odd one ovate-orbicular, with rounded or subcordate base, to rhombic-ovate, acuminate to lanceolate-attenuate, its stalk 1.5–4 cm. long; the lateral leaflets often on short petiolules and, on trifoliolate leaves, usually cleft to form a basal lobe; leaves of the flowering branches on slender petioles mostly 2.5 cm. long, their leaflets ovate to rhombic-oblong, rarely orbicular, variously dentate-lobed; unifoliate leaves coarsely dentate or incised, often 3-lobed, not rarely cordate, sometimes 4–5 cm. broad; inflorescence a short racemose corymb of 3–5 flowers on elongated slender pedicels; often also solitary flowers from the lower axils; pedicels subtended by conspicuous unifoliate or trifoliolate leaves, the two terminal pedicels arising from the axil of a single leaf, all erect, 3–10 cm. long, loosely or thinly villous-pubescent, naked or bearing minute scattered prickles and frequently short gland-tipped hairs, which sometimes extend

into the base of the calyx lobes; calyx lobes rather broad, often with subfoliaceous termination, densely to obscurely subappressed-pubescent; petals oblong to obovate-oblong, mostly 1.5–2 cm. long, young fruit often densely pilose.

Frequent or common on Nantucket in dry or sandy open places or in partial shade. First flowers June 4, 1909, June 7, 1908; still in full flower June 26, 1910.

I have referred here a considerable series of specimens from Nantucket and Long Island, which, although variably intermediate between *R. Baileyanus* and *R. Enslenii* possess in general a certain recognizable individuality. Certain examples, however, appear to be rather arbitrarily separable from *R. Baileyanus*, while others present a similar problem of close relationship to *R. Enslenii*. In general the plant is stouter than *R. Enslenii*, with much broader, more irregularly dentate or lobed leaves and more numerous flowers. As compared with *R. Baileyanus* it is more herbaceous and less prickly, with more coarsely and acutely dentate, often thicker leaves, and weaker pedicels often wholly unarmed.

If, as I have inferred, *R. roribaccus* is a hybrid of *R. Baileyanus* and *R. procumbens*, the plant here considered would seem to answer with the appropriate differences from *R. roribaccus* that might be expected to result if *R. procumbens* were replaced as a parent by *R. Enslenii*.

* RUBUS ENSLENII × FLAGELLARIS.

Low-ascending or prostrate, finally trailing, sparingly branched, sometimes rooting at the tip; stems very slender, subterete, unevenly and often very sparsely armed with short, weak, decurved or retrorse prickles; primary leaves 3-foliolate, on slender, thinly pilose or glabrate petioles, 2–4.5 cm. long; leaflets thin, rather small, 4–6 cm. long, 3–5 cm. wide, mostly obovate, short-acuminate at the apex, more or less cuneate at the base; the lateral pair inequilateral, often rhombic and lobed on the lower margin, subsessile; the odd leaflet on a stalk 0.5–2 cm. long; all thinly pilose-hirsutulous on the upper surface, pubescent to glabrate beneath, on both surfaces bearing minute glands and often subviscid to the touch, irregularly dentate or serrate-dentate with abruptly sharp-acuminate teeth, and often obscurely crenate-lobed; leaflets of the flowering branches sometimes incised; flowering branchlets rather short, 3–12 cm. long, loosely villous-pubescent, unarmed or bearing some minute prickles; inflorescence a 1–7-

flowered, short, slender-pediceled racemose corymb, often naked, but sometimes bracted below with unifoliate leaves; pedicels erect or ascending, very slender, minutely villous-pubescent and usually bearing some minute prickles; calyx pubescent externally, whitened-tomentulose within, the lobes oblong to lanceolate-oblong, apiculate or with a short linear acumination; flowers of medium size or rather small; fruit ovoid-oblong, becoming rather large, 2 cm. long by 1.5 cm. thick, rather large-seeded and subacid, the carpels glabrous or nearly so.

Frequent in dry open ground or in pine groves. First flowers June 7, 1908, June 10, 1909; still some flowers June 22, 1910; ripe fruit August 7, 1906.

A plant not less perplexing than others of its immediate group, in some of its forms approaching very near to *R. Enslenii*, in other forms showing near relationship to *R. flagellaris*. From the former it differs in its larger size and often stronger and more numerous prickles, shorter petioles, broader, more cuneate and more abruptly acuminate leaflets, often subviscid to the touch, and more numerous smaller flowers in subcorymbose racemes. It is a smaller and more pubescent plant than *R. flagellaris*, with weaker prickles, thinner, more coarsely and acutely cut, and more cuneate leaflets, less leafy racemose inflorescence of very slender-pediceled flowers, the carpels glabrous or with an occasional pilose hair.

* RUBUS BAILEYANUS×FLAGELLARIS.

At first ascending, finally long-trailing and rooting at the tip; shoots obscurely angled, becoming subterete, often somewhat branched, armed, often very unevenly so, with rather numerous short, sharp, retrorse or decurved, weak prickles; primary leaves 3-foliolate, or the later ones occasionally 5-foliolate, on thinly pubescent or glabrate petioles 4–6 cm. long, which are armed like the stem; leaflets rather dull green, paler beneath, often strongly purplish tinged, thinly appressed-pubescent on the upper surface, softly short-pubescent to glabrate beneath, acutely and often very irregularly serrate-dentate or cut-dentate and somewhat crenate-lobed; the odd leaflet ovate to obovate-suborbicular, rounded or subcordate to somewhat cuneate at the base, acute or acuminate at the apex, mostly 5–7 cm. long by 4–6 cm. wide, on petiolules 1–2 cm. long; lateral leaflets subsessile to distinctly stalked, mostly rhombic-ovate to ovate-oblong and inequilateral, with a broad basal lobe; flowering branchlets slender, 6–20 cm. long, pubescent or glabrate, unarmed or with some minute scattered

prickles; trifoliolate leaves often subtending long-pediceled axillary flowers and succeeded above by one or more conspicuous unifoliate leaves; leaflets commonly broad and rather coarsely and irregularly dentate or dentate-serrate; inflorescence cymose-racemose; flowers mostly 3–6, on slender erect pedicels 2–8 cm. in length; pedicels loosely pubescent, either unarmed or setulose even on the same plant, often bearing minute scattered, sessile or even stipitate glands; calyx lobes broad, usually merely apiculate, glabrate to tomentulose on the outer surface, cottony-pubescent within; flowers often large, spreading 3–5 cm.; petals mostly broadly oblong; young fruit arachnoid-pubescent.

Frequent in open sandy ground. First flowers June 5, 1910, June 9, 1909, June 11, 1908; mostly out of bloom June 20, 1908.

The plants assembled under this head are a variable series, which agree in showing characters of both the assigned parents. Their actual origin is, of course, exceedingly problematical, especially since certain specimens suggest beside the imputed parents others of the associated and closely related species. It would appear, however, in reviewing the allied crosses, that all other possible hybrids in the group are better accounted for by other plants herein described. The intricacy of the entire problem, which is illustrated no more definitely in this case than in others, well shows the obscurity which must continue to invest it in the absence of that exact knowledge which experimental cross breeding alone can supply.

Upon assimilation of atmospheric nitrogen by fungi

L. H. Pennington

For several years the writer has been interested in the question of assimilation of atmospheric nitrogen by fungi. Experimental work was begun in 1907 upon *Fusarium Zeae*[1] at the suggestion of Professor J. B. Pollock, of the University of Michigan, to whom the writer is indebted for many timely suggestions and criticisms.

The fungus was cultivated in several kinds of organic and synthetic media with dextrose, cane sugar, glycerine, or potassium tartrate as the source of carbon. In all cases the fungus made a good growth when nitrogen was supplied in the form of a nitrate; if very small amounts of nitrogen were supplied, the growth was proportional to the amount of nitrogen; if no nitrogen was supplied there was no growth beyond the mere germination of the spore. In no instance did the most careful chemical analysis of the fungus felt and the medium in which it grew, show any increase in the amount of fixed or combined nitrogen.

These experiments led to similar experimental work with other species of fungi to determine whether any of them have the power to assimilate or fix atmospheric nitrogen, and to ascertain, if possible, why so many contradictory results have been obtained by different investigators. For example, Berthelot,[2] Puriewitsch,[3] Saida,[4] Froehlich,[5] and Latham[6] have reported positive results with *Aspergillus niger*, while Czapek,[7] Koch,[8] and Winogradski[9] give negative results for the same fungus.

Thus far, two species of *Penicillium*, *Aspergillus niger*, an *Alternaria*, and two species of *Fusarium* have been tried by the methods reported by Ternetz[10] and Froelich.[5] After the appearance of Latham's[6] work, in which she reported a very large increase in the amount of combined nitrogen in some cultures of *Aspergillus niger*, which had been supplied with large amounts of ammonium nitrate, a special series of experiments was tried with this fungus in a medium containing a large amount of ammonium nitrate.

In general, the method has been to grow pure cultures of the fungus in 100 c.c. of the solution in one-liter flasks. These flasks were arranged in a series with wash bottles of sulfuric acid and potassium hydroxid and connected by tubes through their rubber stoppers in such a way that air, freed from all combined nitrogen in the form of ammonia and oxids of nitrogen, could be drawn through the flasks by means of a filter pump. Controls were always used, some consisting of 100 c.c. of the medium without the fungus, others of cultures of the fungus in the medium to which enough combined nitrogen had been added to insure a good growth of the fungus. At the conclusion of the growing period chemical analyses were made of the cultures and controls to determine the mount of combined nitrogen in each.

In the chemical analyses different modifications of the Kjeldahl method were used. If it was certain that no nitrate was present, Gunning's modification was found to be the most satisfactory; if nitrates were present, the Gunning-Jodlbauer modification was used. When very small quantities of nitrogen were to be determined, as in the culture media in which no combined nitrogen has been put or in a very small fungus felt, the digestion was carried out in the usual way, made alkaline, then distilled and the distillate caught in a volumetric flask containing a small amount of dilute hydrochloric acid. The amount of ammonia was then determined by the colorometric method in which Nessler's reagent and Nessler's comparison tubes were used. When the amount of nitrogen was about 0.5 milligram or less, this method was found to be more satisfactory than the ordinary method by titration. There is also no danger of error by the carrying over of small amounts of the fixed alkali, during the distillation, for they would make little if any difference in the color.

In all cultures in which dextrose was used there was some growth. In the first series the titration method was used and the total nitrogen content of the several flasks was found to be 0.44–0.62 milligram. A blank with one gram of dextrose gave 0.42 milligram of nitrogen. In the next series, the colorometric method was used and all analyses of blanks and cultures in which cane sugar, glycerine, and potassium tartrate were used gave amounts of nitrogen between 0.30 and 0.37 milligram. At the same time

analyses of blanks and cultures in which dextrose was used gave amounts of nitrogen between 0.44 and 0.47 milligram. From these results it is evident that although the dextrose contained a very small quantity of combined nitrogen to begin with, no nitrogen was assimilated or fixed in any of the cultures.

In the next series of experiments, cultures of two species of *Penicillium*, *Aspergillus niger*, an *Alternaria*, and another species of *Fusarium* were tried with dextrose (a new stock). In all the flasks there was a little growth. The analyses, again by the colorometric method, gave amounts of nitrogen between 0.53 and 0.60 milligram, with but a single exception. One culture of one *Penicillium* gave 0.88 milligram of nitrogen. Since, however, the growth of mycelium was no greater in this culture than in the others it was thought that the excess of nitrogen may have come from something which might have dropped into the flask during the preparation of the cultures or in the analysis.

In the experiments with *Aspergillus* (*Sterigmatocystis*) *niger* in which Latham's method was followed, the following results were obtained: A thick felt of fungus hyphae was formed in each experimental flask during the six-day growing period. Each fungus felt was carefully filtered, dried, weighed, and analyzed for its nitrogen content. The filtrate was also analyzed for its nitrogen. The total nitrogen content for three cultures was 155.8, 154.5, and 153.1 milligrams, respectively (average 154.5 milligrams), and for three control flasks 156.1, 154.4, and 151.3 milligrams, respectively (average 153.6 milligrams). The individual differences were probably due in part to the fact that the culture medium was measured out in an ordinary graduated cylinder. To test the efficiency of the method of analysis, a sample of ammonium nitrate was carefully weighed and analyzed. The computed amount of nitrogen which it should have contained was 177.92 milligrams; the analysis gave 176.9 milligrams. This was considered very close in view of the fact that ammonium nitrate is deliquescent.

Although these results are in harmony with the generally accepted notion that fungi do not have the ability to assimilate atmospheric nitrogen, the persistency with which reports of nitrogen assimilation by fungi appear demands attention and explanation. There are at least two very probable reasons for the positive

results that have been reported by different investigators. The first is the old and often repeated one of experimental error. This reason or objection may properly be given, for it is a well known fact that the determination of nitrogen by the Kjeldahl method presents many difficulties even to those who are more or less expert in making such analyses. This statement will be borne out by an examination of the reviews and reports of controversies among agricultural chemists over nitrogen determinations. One instance may be cited. Barral reports that new block tin condensers were found to absorb considerable ammonia so that accurate results could be obtained only after they had been in use a certain length of time. Such a source of error might cause a whole series of controls to show on analysis a smaller amount of nitrogen than a like series of experimental cultures. When the analyses of six similar cultures in 50 c.c. of culture medium give amounts of nitrogen varying from a loss of 44.9 milligrams in one flask to a gain of 193.6 milligrams in another, it is not safe to assume that free nitrogen has been fixed even although the average for the six cultures may be higher than the average nitrogen content for six controls. The results for the individual cultures should be more nearly uniform or there should be a reasonable explanation for the great differences in the nitrogen content of the different flasks. The objection on the ground of experimental error has added weight when we consider that many of these experiments have been carried out by persons who are amateurs in chemical analysis.

The second reason, which does not seem to have been advanced as yet, is suggested by work such as has been done with *Penicillium* by Thom.[11] It is very possible that there are some strains or varieties of fungi which have the ability to use nitrogen while many other very similar strains do not have that ability. Different species may have been confused and used under the same name by different writers. Undoubtedly several species have been used under the name of *Penicillium glaucum*, and the same may be true with regard to other species of fungi. With the view of obtaining more definite data upon this problem, experiments are now under way in our laboratory to obtain as many as possible distinct strains of fungi by cultural methods and to test them as to their ability to use free nitrogen.

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SYRACUSE UNIVERSITY.

Two new species of Opuntia

BERNARD MACKENSEN

From the writer's studies of Texas cacti, extending over several years, he has been able to ascertain that there are still a number of undescribed species and varieties among the numerous Texas representatives of that interesting family. It may seem strange that a field so often tramped over by botanical collectors should still yield a number of new though comparatively common forms, especially when these belong largely to the conspicuous opuntias. The explanation of this fact is suggested by the writer's own experience in recognizing and differentiating new species and varieties. It was only after keeping the native opuntias, growing all about him, under critical observation for one or more years, and making careful notes, that the writer had revealed to him the presence of undescribed forms. In one case it was not until the maturing of the fruit, which is very characteristic, that the writer was able to make out a clear case of a new species. The transient collector would probably have confounded this with some other species, unless he had perchance visited the locality while the plants were in fruit.

Among the new forms mentioned are two which the writer has characterized as follows:

Opuntia leptocarpa sp. nov.

Plants with somewhat fleshy, terete, or sometimes thick-tuberous, roots: stems mostly ascending, rarely 5 dm. high; joints thin, obovate to oval and elliptic, somewhat glaucous while young, deep green when older, or paler in age, mostly 1 to 2 dm. but sometimes 2.5 dm. long, with subulate leaves 5 to 8 (or sometimes 10) mm. in length: areoles remote, rather small, filled with reddish brown bristles and pale wool when young, the bristles 1 to 7 mm. long and growing dirty brown with age, the lower areoles usually naked, the upper bearing 1 to 4 or sometimes 5 unequal spines, or on some joints mostly spineless; spines whitish, light brown, or mottled, slender, 1 to 3 cm. long or sometimes longer, flattened or nearly terete, twisted, spreading, or sometimes the lowest spine of an areole much reflexed: flowers yellow with a pale reddish

brown (or sometimes darker) center, about 7 cm. broad and 8 to 10 cm. long; petals 4 cm. long, obovate, with a large cusp; stigma white, 6- to 8-lobed, about equaling the stamens: fruit elongated (2.5 to 3.5 cm. thick, 5 to 9 cm. long, or sometimes longer), consisting of an elliptic body, with a narrow (often funnelform) umbilicus and a more or less stipiform base, which is sometimes equal in length to the body but usually shorter, the fruit in ripening becoming purplish throughout and finally crimson externally, the base becoming colored tardily, the taste nauseous: seeds suborbicular, nearly or fully 4 mm. in diameter, when dry gray with a buff margin.

The plant blooms in April and May and produces an abundance of fruit, which ripens in August and September. The fruit is sometimes proliferous.

This species is intermediate between the groups represented by *Opuntia macrorhiza* and *O. Lindheimeri*, respectively. It differs from both in a large proportion of the points covered by the description, so that it is necessary to consider it a distinct species. The slenderness of the fruit is very characteristic, hence the specific name.

The description was drawn from plants growing in their native habitat at San Antonio, Texas, and here, too, the type material was collected in 1910. The type is *no. 618292* in the U. S. National Herbarium.

Opuntia Roseana sp. nov.

Plants with somewhat fleshy terete and thick-tuberous roots: stems commonly several, mostly erect or ascending, sometimes attaining a height of 3 dm., often consisting of an unbranched row of joints; joints mostly relatively thick, obovate to orbicular, 4 to 13 cm. long, often with a shriveled appearance; leaves stout, 2 to 3 mm. broad at base, 4 to 7 mm. long; areoles (often on a decided prominence) filled with pale yellow or whitish bristles 1 to 6 mm. long, only the areoles about the margin of the upper half of the joint armed, or often the entire joint spineless; spines usually white, some joints with a few amber or brownish ones, slender, very short to 2.5 cm. long (or in rare cases 3 to 5 cm. long and very slender), twisted, nearly terete, 1 to 2 or sometimes 3 to an areole, the lower one often reflexed, the others usually erect or spreading: flowers pale yellow with a claret center, about 6 cm. broad and long; stigma white, 5- or 6-lobed, equaling the stamens: fruit obovate-oblong to elliptic-oblong, often narrowly so, 1.5 to 2 cm. wide, 3.5 to 4.5 cm. long, with a crateriform umbilicus, a dull

pink to rose purple outer layer, and a nearly colorless, pleasant-tasted pulp: seeds suborbicular, relatively thick (4 mm. long, 2.5 mm. thick), dirty yellow, with grayish areas on the flat sides, the margin thin and whitish at the raphe.

Flowering in May, the fruit ripening in August and September and not proliferous.

The flowers and fruit of this species show a close relationship to *Opuntia macrorhiza*, but the decided differences in habit, spines, and bristles, and the numerous minor differences, are sufficient justification for regarding it as a distinct species.

The description was drawn from plants growing in their native habitat at Kerrville, Texas, in May, 1910. At the same time a number of plants were transported to San Antonio, Texas, and replanted, and from these the type material was chosen in October of the same year. The type is *no. 618290* in the U. S. National Herbarium.

The species is named in honor of Dr. J. N. Rose of the United States National Museum.

SAN ANTONIO, TEXAS.

Two new species of edible fruits from Mexico

H. H. Rusby

Mayepea macrocarpa sp. nov.

A shrub about a meter high, with elongated, slender branches, which droop or partly recline on adjacent shrubbery. Fruiting branchlets short, stout, brown; petioles 5–10 mm. long, stout; blades 5–10 cm. long, 3–7 cm. broad, oval to obovate, obtuse or subrotund at the base and ending in a very slightly produced, blunt summit, entire, tomentellate underneath, nearly glabrous above, the venation slightly prominent underneath, the principal secondaries about 6 or 8 pairs, with smaller intermediate ones; fruits mostly about 6 to 12, in short, broad, paniculate cymes, at the ends of short stout branchlets borne near the ends of the branches; pedicels very short, mostly broader than long; drupes olivelike, 2–2.5 cm. long and two thirds as broad, ellipsoidal, umbilicate at the base, deep bluish purple, smooth; stone crustaceous, slightly sulcate, occupying about two thirds of the length and diameter of the drupe.

The single specimen seen bore only mature fruit.

Limon Mt., near Balsas, Guerrero, Mexico, at an altitude of about 1400 m., July 2, 1910. Collected by the author.

Morus mollis sp. nov.

A small, spreading, intricately branching tree, resembling *M. alba*, about 4.5 m. high, the trunk nearly 3 dm. in diameter; branches elongated, slender, tough; stipules not seen; twigs and petioles light reddish brown, puberulent when young; petioles 7–15 mm. long, nearly terete, stoutish; blades 3–10 cm. long, 2–6 cm. broad, ovate, equilateral, rounded at the base, abruptly contracted at the summit into an acutely tapering point; margin entire; venation pinnate, prominent on the lower surface, the secondaries about 10–12 on a side, strongly interarching close to the margin and connected by the tertiaries; both surfaces tomentellate, the lower one more so; aments (only pistillate seen) solitary in the axils, the recurved peduncles rather slender and about half as long as the aments. Immature fruits broader than long, when mature rather longer than broad, 1–3 cm. long, pale pinkish yellow, having the appearance of a raspberry, soft and juicy, of weak flavor and only moderately sweet.

Species much resembling *M. celtidifolia* H.B.K., but the leaves broader and not at all rough.

A single specimen seen, bearing ripe fruit.

Collected in the edge of a gulch near Cuicatlan, Oaxaca, Mexico, July 14, 1910, by the author.

NEW YORK COLLEGE OF PHARMACY.

INDEX TO AMERICAN BOTANICAL LITERATURE

(1907–1911)

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in its broadest sense.

Reviews, and papers which relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omissions, their kindness will be appreciated.

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